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# Politicians and Firms in Seven Central and Eastern European Countries

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This study of how privatization and stabilization (hard budget constraints) affect enterprise behavior shows that privatized firms consistently outperform state enterprises in productivity growth. Total factor productivity improves in privatized firms, where there is also less overemployment than in state enterprises.

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## Summary findings

Claessens and Djankov test several propositions derived by Shleifer and Vishny (1994, 1996) about how privatization and stabilization (hard budget constraints) affect enterprise behavior.

They document the changes in financing, employment, and operating efficiency that have occurred in more than 6,300 manufacturing enterprises in seven Central and Eastern European countries (Bulgaria, Czech Republic, Hungary, Poland, Romania, Slovak Republic, and Slovenia). They then compare the relative performance of privatized and state-owned enterprises.

Controlling for institutional differences and the endogeneity of privatization choices, they find that privatization is associated with significant improvements in total factor productivity and reductions in employment. Reductions in soft financing are associated with further productivity gains.

State-owned enterprises employ more workers, have lower worker productivity, receive more financing and direct subsidies, and have higher variable costs than privatized firms, particularly firms privatized for more than three years. Privatized firms also consistently outperform state enterprises in productivity growth.

Over time, the role of politicians in allocating bank financing and subsidies appears to have declined, however, and banks have played a greater role in (efficiently) allocating resources. And the institutional environment appears to have improved in most countries, suggesting that the influence of corruption has declined over time.

The results — which provide significant support for the Shleifer-Vishny model — demonstrate the beneficial effects of privatization in the presence of stabilization and decreasing corruption.

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This paper — a product of the Financial Economics Group, Financial Sector Practice — is part of a larger effort in the network to study transition economies. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Rose Vo, room MC10-628, telephone 202-473-3722, fax 202-522-2031, Internet address hvo1@worldbank.org. The authors may be contacted at cclaessens@worldbank.org or sdjankov@worldbank.org. August 1998. (31 pages)

# Politicians and Firms in Seven Central and Eastern European Countries

by

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## I. Introduction

Many countries have launched large-scale privatization programs in the last two decades, including developing countries (such as Mexico) as well as developed countries (such as France and the United Kingdom). The most ambitious privatization programs, however, have been the ones undertaken in the transition economies of Central and Eastern Europe and the former Soviet Union. In these economies, all enterprises were state-owned in 1990, but by 1996 several transition economies had privatized the majority of them. For example, 90% of Czech enterprises were transferred to private hands in the period 1992-96. Despite the scale of privatization programs in both market economies and transition economies, only limited empirical evidence has been available on the effects of privatization on enterprise performance and aggregate welfare. Answers are still incomplete to critical questions like: do privatized firms become more profitable; if so, when; do they restructure more; if so, why; do they increase productivity, if so, how.

In spite of strongly held convictions about the benefits of privatization among policy advisors and international development agencies, the answers to these questions are not obvious from a theoretical standpoint. Theory would indicate that state enterprises can perform better than privatized firms in maximizing social welfare. State enterprises are more likely to take into account externalities—differences between private and social returns and benefits—arising from differences in private and social objectives and monopoly power (Atkinson and Stiglitz, 1980). Externalities could arise from spillovers, e.g., technology transfer (positive spillover), pollution (negative spillover); or from vertical or horizontal linkages between firms. Market power has often been used as an argument for state ownership in developing countries given the often small size of their markets and the difficulty in regulating natural monopolies. At the same time, theory argues, state enterprises need not be worse in producing efficiently and charging prices which reflect marginal costs. If the institutional environment were properly established, sufficient competition in the product market could make ownership structure irrelevant in determining enterprise performance (Vickers and Yarrow, 1988).

The empirical findings to date, however, cast doubt on these theoretical predictions. State enterprises are generally found to be less efficient, have excess labor and higher wages, tend to accumulate losses, and do not necessarily take into account externalities (e.g., state enterprises in Brazil were found to pollute more, World Bank 1995; state enterprises in the Slovak Republic were less willing to buy advanced technology from foreign firms, Djankov and Pohl 1997). Studies generally find that private ownership is associated with higher efficiency, higher profitability, more shedding of excess labor and greater overall welfare (Galal et al., 1994). Relatedly, privatization has been found to lead to significant improvements in firm performance (see Vining and Boardman, 1992 for a survey).

Critics of the benefits of privatization have pointed to a number of measurement problems in these empirical studies. The majority of studies rely on a small number of privatized firms and often simply compare enterprise performance before and after privatization. Examples include

Galal et al., 1994, Megginson et al., 1994, Boubakri and Cosset, 1997. Such studies do not address the endogenous nature of privatization. For example, governments often resort to privatization when the economy is doing badly (see Alesina and Drazen, 1991; Drazen and Grilli, 1993 for theoretical models). Better enterprises are also more likely to be privatized. By the time privatization programs are implemented, the economy is frequently in an upturn and better enterprises are likely to increase productivity more regardless of ownership. A second group of studies (Picot and Kaulmann, 1989; Vining and Boardman, 1992; LaPorta and Lopez-de-Silanes, 1997) attempts to alleviate these identification problems by including in their analysis state-owned enterprises operating in the same sector(s) as a control group. These three studies, however, suffer from inadequate data coverage. Lastly, none of the empirical work to-date has controlled for the effect of different institutional environments, especially the overall external environment including monetary stability, although this is a major component of the theory of privatization (an exception is Picot and Kaulmann, 1989). This is because data are frequently analyzed for a single country only.

The Shleifer and Vishny (1994 and 1996, SV) model provides a more complete analytical framework to study the benefits of privatization. It investigates the interests of politicians to have state enterprises employ excess people at above market wages so as to obtain more political support. The model also incorporates the effect of corruption on enterprise performance and indicates a number of specific hypotheses. First, privatization alone will not lead to improved efficiency. A necessary condition for privatization to generate efficiency gains is a simultaneous improvement in the overall legal and judicial framework leading to a reduction in corruption. Second, only when privatization is accompanied by allocation of control rights to managers, deregulation and increases in competition, will there be positive impacts on firm performance. Third, corporatization can promote enterprise restructuring, even though it may soften the budget constraints enterprises face. Fourth, corruption may have stimulative effects on enterprise restructuring as it allows managers and politicians to "contract" in achieving more efficient allocation of resources. Finally, stabilization, i.e., a reduction in subsidies and soft credits to enterprises, will have large allocative and efficiency benefits.

This paper builds on the SV model by documenting the impact of privatization on enterprise performance for a sample of more than 6,300 former and still state-owned firms from seven Central and Eastern European countries. Our analysis accounts for the effect of different institutional environments by controlling for country-specific factors, for the effect of market competition by controlling for industry-specific factors, and for the sample selection problem by correcting for possible endogeneity of privatization outcomes. In particular, we follow the performance of privatized firms over time, i.e., before and after privatization, as well as their relative performance in comparison to still state-owned firms in the same sector and country. We also use a two-step estimation procedure that allows us to test several theoretical predictions without introducing measurement problems that have plagued previous empirical studies.

We find strong supportive evidence for the predictions of the SV model. The results show that, on average, privatized firms have five times higher total factor productivity growth than still state-owned enterprises even when one controls for the endogeneity of privatization choices, the degree of bank lending and subsidies, and the different levels of corruption and development of

legal frameworks across countries. Privatized firms also reduce their excess labor by 20% more than comparable, still state-owned firms and cease to receive direct government subsidies. These differences in performance between privatized and state-owned enterprises cannot be attributed to the overall environment in which enterprises operate nor to the selection bias introduced in the privatization programs. We also find empirical evidence for the SV-prediction that lack of monetary tightness discourages enterprise restructuring, at least in the early period of transition. The role of politicians in allocating bank financing and subsidies appears to have declined over time, however, and the importance of banks in allocating resources (efficiently) increased. Finally, the overall environment appears to have improved in almost all countries, suggesting that the influence of corruption has declined.

The paper is organized as follows. Section 2 summarizes the previous empirical literature on the benefits of privatization and the arguments of its critics. Section 3 develops several testable hypotheses based on the Shleifer-Vishny 1994 model. Section 4 describes the dataset (and its drawbacks) and provides simple statistics on several variables of interest. Section 5 details the empirical research design. Section 6 provides descriptive statistics of the main variables, while Section 7 reports the results from the tests of the SV model. Section 8 concludes.

## II. The empirical literature on privatization

There is a substantial empirical literature examining the relative performance of public and private enterprises. This work was motivated by the notion that private ownership leads to better incentives to monitor managers which in turn would raise enterprise performance. Since there did not exist a rigorous theoretical framework to underlie such empirical analysis, the evidence remained mostly anecdotal and frequently led to conflicting conclusions. On the one hand, several papers (Kay and Thompson, 1986; Millward, 1982; Wortzel and Wortzel, 1989) argued that increased competition in product markets is a more important determinant of improved allocative efficiency than privatization. Boresherding et al. (1982), for example, find that "given sufficient competition between public and private producers, the differences in unit costs turn out to be insignificant." On the other hand, a number of other papers (Bailey, 1986; Bishop and Kay, 1989; Kikeri et al., 1994) present (mostly anecdotal) evidence of the beneficial role of privatization in enhancing enterprise efficiency.

The difficulty of the previous empirical research to establish a conclusive analysis on the benefits of privatization was in part due to the limited natural experiments of privatization prior to the programs in Mexico and the United Kingdom in the mid-1980s. In the majority of cases, privatization occurred in a small number of utility enterprises (telecoms, airlines, oil refineries). A recent survey (Vining and Boardman, 1992) covers 87 papers on the effects of privatization. Of those, only two (Broadman and Vining, 1989; Picot and Kaulmann, 1989) focus on competitive sectors rather than on regulated monopolies or oligopolies. The authors argue, as does subsequent research, that utility privatizations do not provide a useful test of the benefits of privatization since these enterprises still fall under often unchanged government regulatory frameworks. Hence the effect of privatization cannot be measured separately since productivity gains are confounded by the effects of (lack of) changes in the regulatory framework. Also, 74 of

these studies use data on developed countries only. This may be of little relevance for developing and transition economies which do not have a well-established regulatory framework, and highly-qualified public sector managers as those in the United Kingdom. Thus, the frequent rejection of the hypothesis that privatization leads to performance improvements (only 28 of the 87 studies report such findings) may not be surprising.

The more recent empirical literature on privatization focuses on developing countries (LaPorta and Lopez-de-Silanes, 1997) or on a cross-section of industrialized and semi-industrialized countries (Boubakri et al., 1997) of firms in (mostly) competitive sectors. These studies use larger datasets which allow for a direct test of the relative efficiency of state-owned versus private enterprises, but do not take into account the effect of different institutional environments. No study to-date has, for example, estimated the separate effects of privatization and stabilization (hardening of budget constraints). An exception is Picot and Kaulmann, 1992 which controls for country and sector effects in a cross-section of six developed countries. Nevertheless, privatization is found to have a positive effect on profitability, labor productivity, and new investment flows in all three studies.

Much of the empirical literature on the benefits of privatization preceded the theory of privatization and hence lacked a methodological framework to analyze its findings. It did, however, serve -- coupled with a healthy doze of faith -- as the basis for the large scale privatization programs in the transition economies. Now, equipped with both the SV model on the benefits of privatization and data from seven transition economies, it is an opportune time to test some of the hypotheses on the relationships between privatization and firm performance.

## III. The new theory of politicians and firms

With the collapse of central-planning in Central and Eastern Europe and the (then) Soviet Union interest in the theory of privatization emerged. The pathbreaking study in this literature (Boycko et al., 1993) was motivated by (and influenced) the Russian mass-privatization program. The model, and its subsequent refinements (Shleifer and Vishny, 1994 and 1996), focuses on the separate impact of privatization, deregulation, and stabilization, as well as corruption on enterprise performance. It identified a number of specific empirically testable hypotheses. The model cast doubt on the robustness of previous empirical findings which did not account for deregulation, stabilization, and corruption, and narrowly focused on privatization.

The SV model centers around the political economy aspects of privatization. In particular, the focus is on the interests of politicians to have state enterprises employ excess people at above market wages (or to charge prices below marginal factor costs to favored consumer groups or be inefficient more generally) so as to obtain more political support. The SV model separates the effects of control rights and cash flow rights. Four types of firms are distinguished: state enterprises, i.e., with control rights and cash flow rights in the hands of the state; commercialized state enterprises, i.e., with control rights with managers but cash flow rights with the state; regulated private firms, i.e., with control rights but no cash flow rights with private owners; and private firms, i.e., with control rights and cash flow rights with private owners. The SV model

also allows for a discussion of the effects of the degree of corruption and bribes on enterprise performance under various scenarios of privatization and commercialization.

The SV model indicates a number of specific hypotheses. First, with full corruption, the allocation of control and cash flow rights does not influence the resource allocation. Basically, a Coase Theorem holds as managers and politicians internalize all benefits and costs and obtain an efficient allocation of resources. Privatization alone will not change the resource allocation. A necessary condition for privatization to generate efficiency gains is a simultaneous improvement in the overall legal and judicial framework leading to a reduction in corruption. Second, privatization in itself may not have the desirable consequences of lowering excess labor and improving efficiency. Only when privatization is accompanied by allocation of control rights to managers, deregulation and increases in competition, will there be positive impacts. Third, corporatization can promote enterprise restructuring, even though it may soften the budget constraints enterprises face. Fourth, corruption may have stimulative effects on enterprise restructuring as it allows managers and politicians to "contract" in achieving more efficient allocation of resources. Fifth, stabilization, i.e., a reduction in subsidies and soft credits from the central bank to enterprises, will have large allocative and efficiency benefits.

These hypotheses already suggest a number of simple comparisons between state-owned and privatized enterprises. State enterprises should have higher costs, receive more subsidies, employ relatively more labor, and have generally lower labor productivity than privatized enterprises. The hypotheses also suggest a number of important factors to include in the empirical research design. First, one needs to control for overall changes in the external environment enterprises face. This concerns both the degree of (de)regulation and the degree of competition. Many privatizations take place in a rapidly changing economic environment, particularly in transition economies. Prices are being deregulated, trade barriers removed, and more new entry is allowed for. This may affect performance and other measures of enterprise restructuring even in the absence of privatization, e.g., profitability may decrease as a result of increased competition, or increase as a result of prices being liberalized. It is not sufficient then to compare performance measures before and after privatization. Obviously, it is difficult to control for the specific external environment each enterprise faces, as this will depend on country-wide and sector-specific government policies, market structure, etc. One way to account for these conditions is to use panel regressions and include both state-owned and privatized enterprises in the same sectors and countries. This allows one to capture the effect of privatization by "mean-differencing" the various measures of enterprise performance, taking state-owned enterprise performance as a benchmark.

Second, the SV model indicates that the overall legal and regulatory framework (and possibly different social norms) needs to be to controlled for as it affects the degree of corruption. This could be done by using some of the institutional indexes which are now often utilized in cross-country growth regressions. Many of the cross-country indexes used for describing the overall policy and institutional environment do not, however, show much variation for the Central and East European countries covered here (Claessens et al., 1997b). The Czech Republic and Hungary, for example, get identical ratings on all available indices although there are substantial differences in the speed (and sequencing) of institutional reforms in the two countries. A better

way to control for institutional differences across countries and over time is to use enterprise data from several countries, i.e., enterprises under different institutional environments, and apply a random-effects model. This way one controls for differences in the legal and other aspects of the overall external environment, as well as enterprise-specific heterogeneity.

Third, the SV model indicates that the degree of stabilization can greatly affect enterprise performance. Improvements in enterprise performance may then wrongly be attributed to privatization when they are mainly due to hardening of the budget constraint. A cross-country comparison through a panel approach would correct for differences in overall monetary tightness. But, the hardening of the budget constraint may differ across enterprises, as the political costs and benefits of soft budgets may depend on the size of the enterprise, the labor intensity of production, type of products, etc. It is thus necessary to use firm-specific proxies for hardening of the budget constraint. One candidate is the (change in the) amount of new bank lending to the enterprise in question since, ex-post, much of it often ended up being subsidies in disguise. Direct subsidies from the state can also be included.

Fourth, and this a more general point, the SV model indicates that it is necessary to control for initial conditions at the enterprise level. Enterprises are differently endowed in terms of quality of machinery, labor, management, links with foreign markets, etc. This is especially the case in transition economies where the decisions on new investment, worker training, etc., were taken at the central level and were seldom driven by previous track record. It may have given some firms a competitive advantage or disadvantage once liberalization took place, leading to higher or lower profitability. Some of this can be captured by controlling for sectors, but not all. Provided there is no clear relationship of initial conditions with privatization, this still need not bias any results. There has been a presumption, however, that better firms are more likely to be privatized. As a result, measures of productivity would be biased when comparing the performance of privatized and state-owned enterprises. One should thus control for the initial level of productivity. Furthermore, it can be expected, as confirmed for market economies, that firms' productivity tends to converge over time, i.e., increased competition will make higher profitable firms less profitable (Waring, 1996). When combined with a selection bias of better firms more likely to be privatized, this may mean that in terms of changes in profitability, privatization is associated with an actual worsening of performance over time.

The SV model also suggests a number of clear predictions of the effects of privatization on profitability, labor and efficiency. These are summarized in Table 1. Under full corruption excess labor is not reduced and efficiency does not change with privatization. The only affected variable is soft financing which decreases as politicians incur higher cost in handing out subsidies. The effect of privatization in the absence of deregulation and without stabilization leads to perverse results. While in a public firm the politician needs to pay for excess employment through politically costly subsidies, in a regulated privatized firm he can force the managers to pay for the increase in excess labor and decreased efficiency. This suggests that, in the absence of full corruption, regulation might be an even greater problem than public ownership. Privatization with deregulation, but without stabilization increases soft financing, as the managers are in a

better position to extract favors from politicians. On the other two restructuring measures, excess labor and efficiency, privatization leads to a worsening. Only with both deregulation and stabilization is there an improvement in all three measures.

## IV. Data Description

We have firm-level data (balance sheet and profit and loss statements) for 1992-95 obtained from private firms (Czech Republic and Hungary) or statistical offices (Bulgaria, Poland, Romania, Slovak Republic, and Slovenia). Typically, the data cover manufacturing firms which were registered as state-owned enterprises (SOEs) in 1991. The data are annual observations at the plant level and cover the majority of plants in manufacturing industries. If some plants are owned by the same parent company, this relationship is accounted for in the data. The data, although not always a complete manufacturing census, are representative of the manufacturing sector in each country. Two types of selection bias are present - informal enterprises are excluded and small formal firms are underrepresented. Thus the sample primarily covers medium and large enterprises in the formal sector.

We exclude all firms which have missing observations and form balanced panels, i.e. all firms show up throughout the 1992-95 period.[1] The majority of the excluded firms have missing values between the beginning and end of the sample period, which suggests that they were not liquidated. There is no new entry of SOEs in the sample period (entry through split-ups and spin-offs is captured in the data). The information concerning exit of SOEs is not utilized here since we cannot distinguish between apparent exit (due to non-reporting) and true exit (due to liquidation or bankruptcy).

In three countries (Romania, Slovak Republic, Slovenia) we have almost complete coverage, while the data for the other four countries contain about half of the formal manufacturing sector. This is due to two reasons. First, as explained earlier, small firms are not well-covered in the analysis. In the countries where small business was allowed to operate even prior to 1991 - Hungary and Poland - this means that a relatively larger share of firms is not included. Second, countries that have introduced changes in enterprise codings also show smaller coverage. This is especially the case for Bulgaria, where many firms changed their code number (as reported to the Statistical Office) once they were corporatized in 1994. A similar problem exists in the Polish data. During the 1993-95 period, over 1,000 Polish manufacturing firms were sold through liquidation-privatizations. The process meant that a new company emerged, which was not easily traceable (by the econometrician) to the old state firm. This type of enterprises are hence underrepresented in our data - we have been able to include only 147 such firms in the analysis.

Although international accounting standards (IAS) were introduced in all seven countries (as of January 1995 in Bulgaria and Romania; a year earlier in the other five countries), many

[1] This procedure mostly affects the Bulgarian dataset. Although we have the complete manufacturing census, only half of all firms report consistently in all years.

firms still report according to the old system. For those firms, we have used the conversion accounting tables for each country as produced by PriceWaterhouse. The analysis is then based on IAS across all firms. Sales and inventory changes are reported in all cases. This allows us to adjust the revenue numbers to account for sold (rather than produced) output during the period when countries still used old accounting conventions. Firm-specific output prices are not available. Instead, we use output price indices at the industry level, as reported by the respective statistical offices. All nominal values are deflated using these price indices. This limits the comparisons between firms within the same sector and country, but would not appear to introduce a significant bias in comparisons across sectors or countries. We recognize, however, that the use of separate inflation corrections across firms may be beneficial, given the likely variation across firms. The last year of the sample (1995) is taken as a base year on the assumption that relative prices are closer to relative market prices than in earlier years.

The data on factor inputs include detailed information on firm expenditures, employment, and average hours worked. Expenditures on energy are available separately from other material inputs' expenditures. We use industry-level input and energy price indices reported by the statistical offices to deflate nominal values. Following Gordon and Li (1995), we use purchased inputs rather than used inputs in constructing our material input variable. Under this definition, output produced using materials drawn from inventory results in increased productivity.[2] Data on firm-specific fixed assets are also available but not used in the analysis. Table 2 lists for each country the number of firms in the dataset, aggregate employment in 1992, and its share of total manufacturing employment, and the sectoral distribution of employment, as well as descriptive statistics on employment (mean and median number of employees).

The data cover 6,354 firms with over 6.5 million employees. Polish and Romanian firms are the largest among the seven countries - they have a mean number of employees of 911 and 1,521 respectively. This is hardly surprising since the two countries have also the largest total population among the sample countries. The sectoral distribution of employment in the dataset varies across countries, with Bulgaria, the Czech Republic, and Poland displaying a high concentration in the Non-Electrical machinery sector, Hungary in Textiles, Romania and the Slovak Republic in Fabricated metals, and Slovenia in Electrical machinery.

Each firm reports its ownership status starting in 1991. This is reported as a discrete variable (privatized\state-owned). In addition, the data show what ownership share of the firm went private in a particular year. To avoid possible differences in the definition of private firms, we choose to call a firm privatized when more than a third of its shares is privately-owned. This choice was made based on the existing corporate laws in the Central and Eastern European countries. In all seven countries, major strategic and investment decisions at the firms' Board of Directors can be taken with only two-thirds majority. Thus if more than one-third of shares are privately owned, collectively private owners can block decisions at the Board. Based on this

[2] We also took the used material expenditures as a basis for the material input variable (not reported). The results are robust to either specification.

criterion, the sample contains 3,752 still state-owned firms in 1995, 365 firms privatized in 1994, 864 firms privatized in 1993, and 1,391 firms privatized before 1993. The Czech and Slovak Republics have the largest share of privatized enterprises - 90% and 80% respectively. Bulgaria and Romania, on the other hand, privatized only 8% and 12% of their manufacturing sector during the sample period.

Although the data include information on the type of ownership (foreign strategic investor, management-employee buy-out, etc.) we do not use it in the main part of the analysis. This additional data could be used to estimate the effect of different privatization strategies on enterprise performance. There already exists a separate (but related) literature on the benefits of particular *types* of ownership on firm efficiency (Aghion and Blanchard, 1996; Blanchard, 1996) that can serve as a basis for such empirical analysis. Several studies (Claessens et al, 1997; Pinto and Wijnbergen, 1994; Estrin, 1994) have provided some empirical evidence for the impact of different classes of owners of enterprise performance for some Central and Eastern European countries. We do, however, use the ownership type information in the sensitivity analysis in Section VII.

The data also include information on outstanding bank obligations. We include this variable in our analysis of financial tightening. Ideally, one would like to include wage arrears, arrears to suppliers, social security, and the tax office to assess the overall softness of the budget constraint for each enterprise. Data on these variables were only available for firms in two countries (Bulgaria and Romania) in the 1992-94 period. We do, however, have separately the level of direct subsidies a firm receives from the state, which are under the control of politicians and thus relate to the SV model. Country dummies (Country $_{it}$) allow us to investigate whether there are significant country-specific effects which may change over time. The dummy variables will also account for any omitted government policies which vary across countries and time and which may help explain firm performance. Privatization dummies ($Priv_{1, 2, 3+}$) are constructed for each cohort of firms in terms of the number of years following their privatization. We thus construct three privatization dummies: if a firm has been privatized for three or more years (1 if it has, 0 otherwise), a dummy for firms that have been privatized for two years, and a dummy for firms that have been privatized for one year. Firms that have not yet been privatized are used as a control group. The chosen construction of the privatization dummies allows us not only to estimate the effect of privatization, but also to follow it through time, i.e., we are able to answer the question "what was the effect of privatization on TFP growth in firms privatized for *n* years."

The data have some drawbacks. First, the short time-period allows us to capture the effect of privatization for a maximum of four years following privatization. We might therefore underestimate the benefits of privatization. Since most of the immediate benefits in transition economies come in the form of organizational improvement and do not necessarily depend on longer-term investments, this probably does not significantly bias the benefits-of-privatization coefficient. Second, as noted, we do not have adequate data on some important forms of soft financing such as inter-enterprise arrears, arrears to the budget, and arrears to social security. Their exclusion may lead to an overestimation of the benefits of privatization and underestimation of the benefits of stabilization. Third, although we have data from seven different countries, they have had similar institutional developments (with the possible exceptions of Bulgaria and

Romania). The inclusion of some former Soviet Union republics would have added variation in the analysis. Unfortunately, such data are not available for large samples of firms. Finally, as earlier theoretical work (Boycko et al., 1993) has argued, privatization can have positive spillover effects within a country since it creates a market for managers and thus encourages managers of still state-owned enterprises to perform better. Thus our specification may underestimate the true benefits of privatization at the firm level, attributing some part of it to the improving overall environment.

## V. Empirical Specifications

To test the SV hypotheses, we employ total factor productivity growth (TFPG), which measures changes in a firm's efficiency in using inputs (factors of production, labor, material inputs, and capital) to produce a given level of output. TFPG is the standard measure of productivity and has been widely used in empirical studies of developed economies (Jorgenson et al., 1987) and developing economies (see the papers in Roberts and Tybout, 1996). It has not been used extensively in transition economies. The aversion to using TFPG may be based on the belief that book values of fixed assets are grossly inaccurate and introduce significant noise in any estimation. The exclusion of capital as a factor of production, on the other hand, may lead to biased estimates of productivity—tantamount to assuming that the intensity of capital usage has remained the same over the transition period. We avoid both problems by using energy consumption as a proxy for capital utilization.[3] This correction has many desirable properties (Burnside et al., 1995) and has been shown to be a good and less volatile measure of capital services compared to the standard measures. Most importantly in the transition context, it is a flow measure and does not depend on any (accounting) measure of fixed assets which may introduce biases. Managers of still state-owned firms, for example, may have an interest in reducing the reported value of capital in order to lower the price at which they (or their partners) would purchase the firm thus inflating TFP-growth. The downside of using energy consumption as a proxy for capital utilization is that the substitution of additional capital for reduced energy consumption is obscured.

The TFP-specification we use has three additional important characteristics. First, we estimate directly the marginal product of individual factors, thus allowing for non-zero profits (and imperfect competition and factor market distortions). Second, we do not impose constant returns to scale, as the sum of factor shares is not constrained to add up to one. The relaxation of these two standard assumptions is particularly important in transition economies. Third, we allow for separate production functions for each sector, i.e., we do not impose that firms in all sectors have identical (at a given point in time) marginal factor products.

We start with a standard neo-classical production function

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[3] An alternative approach is to correct for missing capital stock numbers and make inflation adjustments. This does not address the fundamental question whether capital stock is the most appropriate proxy for capital utilization.

$$Y_{it} = T_{it} [L_{it}^{s_{Li}} M_{it}^{s_{Mi}} K_{it}^{s_{Ki}}]^{\gamma_i} \quad (1)$$

where $s_L$, $s_K$ and $s_M$ are the shares of labor, capital and material inputs' expenditures in total expenditure for firm *i*, $\gamma_i$ is the returns-to-scale parameter, and T is the total factor productivity parameter. To avoid imposing cost minimization, we estimate the marginal product of each input as follows:

$$\Delta y_{i,t} = \hat{\alpha}_i + \beta_{Ls} \Delta l_{i,t} + \beta_{Ms} \Delta m_{i,t} + \beta_{Ks} \Delta k_{i,t} + \hat{\varepsilon}_{i,t} \quad (2)$$

where $\Delta y_{i,t}$ ($\ln Y_{i,t} - \ln Y_{i,t-1}$) is the log-difference in total revenues, $\Delta m_{i,t}$ is the log-difference in material inputs, $\Delta l_{i,t}$ is the log-difference in number of man-hours worked, $\Delta k_{i,t}$ is the log-difference in energy usage (our proxy for capital utilization), and the *s* index varies over sectors. Having estimated equation (2), we can calculate TFP growth in year *t* for firm *i* as the sum of the firm's fixed effect ($\alpha_i$) and the regression residual ($\varepsilon_{i,t}$) -- $\Delta \hat{t}_{i,t} = \hat{\alpha}_i + \hat{\varepsilon}_{i,t}$ .

Equation (2) does not allow for the fact that the choice of factor inputs may be affected by the changes in ownership structure or the tightening of financing. While useful as a benchmark (and popular in studies of productivity growth), TFP is estimated as a residual, may capture effects other than privatization, and does not allow one to control for the possible endogeneity of factor input choices. For example, privatization (along with other productivity determinants) may be correlated with the subsequent TFP growth and choice of factor inputs because better firms get privatized (first). To properly control for this and other firm-specific factors, we augment equation (2) as follows

$$\Delta y_{i,t} = \hat{\alpha}_i + \beta_{Ls} \Delta l_{i,t} + \beta_{Ms} \Delta m_{i,t} + \beta_{Ks} \Delta k_{i,t} + \beta_4 \text{Priv1} + \beta_5 \text{Priv2} + \beta_6 \text{Priv3+} + \beta_7 \text{BANKFIN}_{i,t} +$$

$$+ \beta_{8t} \text{Country}_{ii} + (\beta_{9t} \text{SUBS}_{i,t}) + \hat{\varepsilon}_{i,t} \quad (3)$$

Under the new specification we can account for changes in the input composition of production as a result of privatization or hardening of the budget constraints. Table 3 details all variables employed in the analysis.

A major challenge in testing the implications of the SV model is how to correct for the endogeneity of privatization itself. This is less likely to be an issue in countries that went through mass privatization schemes (Czech and Slovak Republics, Slovenia). Although some particularly "bad" enterprises - mainly in the former military production complex and in one-company towns - were excluded, mass privatization covered a large number of enterprises and was mandatory. Poland also completed such a program in late 1994 (initially started in 1991). In this case firms could (and did) lobby to be included in the program. This is usually interpreted to mean that the better firms entered the program since their managers wanted quick privatization. Empirical analysis (Djankov et al., 1997) shows that the opposite happened. The majority of the firms that entered mass privatization were worse than the average state-owned firm in their respective

sector. This bias was due to the distorted expectations of enterprise managers. They initially expected the program to be a "hospital" set up by the government to re-vitalize enterprises. Managers of the better firms, on the other hand, withheld from participation since they expected bigger gains if they could negotiate with strategic investors.

The endogeneity problem is likely to be more severe in samples where firms were mostly privatized through sales to strategic investors (domestic or foreign). Sales to foreign investors were possibly focused on firms with substantial market power. Previous case study evidence supports this hypothesis (Carlin et al., 1995). Sales to domestic strategic investors may have been driven by superior knowledge of the enterprise growth opportunities. This is especially the case for privatization to insiders (management buy-outs, management-employee buy-outs) as discussed in the Polish case. We address this specific issue in Section VII.

To correct for the possible endogeneity of privatization choices, we perform the empirical analysis in two steps. The hypothesis here is that a firm is most likely to be privatized if it was relatively efficient in the pre-privatization period. The approach we use is the generalized Heckman two-step procedure for correcting sample selection bias as developed in Amemiya (1974). The method involves separate estimation of the privatization decision and the subsequent firm productivity growth decision. The first step is a probit model to determine the probability of privatization based on pre-privatization efficiency (proxied by the share of variable costs in total revenues), firm size, and sector origin.[4]

## VI. Sample Statistics

We report five sample statistics that relate to efficiency and enterprise financing. First, we report the average (and median) employment (SIZE) in four groups of enterprises for the first and last year in our sample (Table 4, first panel). The SV model predicts a reduction in excess labor as a result of privatization. We use t-statistics to show the statistical significance of this differential labor shedding. Indeed, enterprises that have been privatized early in the period have shed the most labor. Labor productivity (LABPRO) is a useful measure of restructuring, particularly in the early stages of enterprise adjustment. Again, enterprises that have been

[4] The second step in the Heckman procedure involves an OLS estimation, using only privatized firms, and results in sample selection bias, defined as the omitted variable problem. The procedure provides for a specification of the omitted variable that can be used in the truncated sample to alleviate sample selection. The omitted variable is the ratio of the value of the standard normal density function to the value of the standard normal cumulative distribution function (the inverse Mills ratio) and is computed directly as part of the TSP econometric package we use. Amemiya (1974) generalized the Heckman approach to include all observations in the second step by developing a measure of the inverse Mills ratio for zero observations, i.e., for state-owned firms. We use Amemiya's approach to calculate the inverse Mills ratio and employ it as an instrument for the unobserved (by the econometrician) impacts on privatization decisions. The estimating equation (3) is augmented by the additional independent variable MILLS - the inverse Mills ratio calculated from the results of the probit estimation of privatization outcomes on pre-privatization VCS, firm size, and sector origin.

privatized for over two years improved their labor productivity, while state-owned enterprises did not.

We next compare the extent of bank financing (BANKFIN) across ownership categories. State-owned firms greatly increased their bank borrowing, while privatized firms borrowed significantly less. Subsidies (SUBS) were also distributed predominantly to state-owned enterprises. The exceptions are Bulgaria and Romania where some partially privatized firms received some financing from the budget. Even there, privatized firms were cut-off from direct subsidies by the end of the sample period.

We also look at the variable cost share (VCS) over time. Changes in the VCS reflect a large number of restructuring measures: labor and wage rationalization, adjustment of input use to reflect new relative prices, better output quality and higher sales revenues, and the movement of resources toward higher-productivity firms and sectors. In measuring these changes, we use variable costs rather than net profit.[5] Using the VCS as an indicator of firm restructuring could be misleading if relative prices of inputs change dramatically; changes in VCS would consequently be a poor measure of enterprise performance. Over the 1989-92 period, this was important as price controls on many inputs were removed. It is less important in our sample (1992-95) as the initial price adjustments had already occurred and dramatic changes in prices had become rarer. This measure shows a (statistically significant) increase in VCS as a share of revenues for still state-owned firms. On the other hand, firms privatized for three or more years have reduced their variable cost.

Finally, we document the mean (median) statistics for TFP-growth in each of four ownership groups over time (Table 5). The most striking fact emerging from the data is that enterprises that have been privatized for more than three years (i.e., before 1993) show an increase in TFP which is five times higher than that of enterprises which have remained state-owned (13.2% versus 2.6%). Enterprises that have been privatized for shorter periods also outperform state firms, albeit to a lesser degree (4.9% and 6.2% versus 2.6%). The differences in TFP-growth between state and privatized enterprises are statistically significant for all cohorts of privatized enterprises.

The simple statistics so far support the predictions of the SV model. Although indicative, these measures may be misleading since they do not control for the sectoral composition of each group. They are also partial measures which only take into account certain aspects of the relation

[5] The difference is in not accounting for interest and other financial charges and depreciation. Interest and other financial charges involve a redistribution of income depending on the debt and equity claims on the enterprise. Given the often arbitrary allocation of liabilities under central-planning, the inclusion of interest could introduce unnecessary noise in measuring enterprise restructuring. Depreciation is an imputed charge—again, often based on somewhat arbitrary accounting conventions (and often different across the seven countries), not an obligation to pay someone else.

between privatization and enterprise performance. In particular, firms may have been chosen for privatization because of their growth potential. We correct for this possibility by including the privatization and financing variables directly in the estimating equation in the next section.

## VII. Testing the SV Model

*Random-Effects Model*

We use equation (3) to estimate the direct effect of privatization and budget constraints on firm production. The results are reported in Table 6 using random-effects panel regression over the 1992-1995 period on the whole sample of enterprises. The explanatory power is good, with 85.1% of the total cross-time and cross-firm variation in the TFPG explained by the included independent variables. Sector-specific factor cost variables are always statistically significant in explaining enterprise restructuring.

The dummies for each cohort of privatized firms shed light on the effect and time path of privatization effects. Privatization turns out to be very important in explaining the variation in TFPG. The statistically significant and large positive coefficients on private ownership strongly suggest that changes in ownership have had a large positive effect on efficiency and enterprise restructuring.

Since the privatization variables are dummies, we can interpret their coefficients as elasticities and compare them to each other as well as to the situation with no privatization, but with the same (changes in the) external environment, including the softness of the budget constraint for each firm. The results of Table 6 show that TFP grows by an additional 2.8% in the first year after privatization. Second-year privatized firms have 6.1% higher TFPG than state-owned firms and third-year privatized firms have another 4.2% higher TFP growth. There is thus a time pattern among the privatization dummies which suggest that privatization is most effective in leading to changes in the second year. By the third year, the effect of privatization, while still significantly positive, slows down (but this may also reflect the small number of firms which have been privatized that long).

To measure the effects of the softness of the budget constraint, we use BANKFIN, the net transfer from banks to enterprises. The amount of net new bank lending in each year turns to be also important in explaining firm performance, albeit first in a negative way and then in a positive way. The hypotheses in Section III suggest that enterprise restructuring would be negatively related to the softness of the budget constraint, as politicians bribe managers in return for maintaining higher excess employment. This turns out to be the case for bank financing which occurred in the year 1992. For the next year, bank financing is insignificant and for the last year significantly positive related with subsequent TFP-growth. The relationships and associated elasticities are quite strong: a 100% increase in bank financing decreases subsequent enterprise

productivity by 1.0 percentage points in 1992 while it increases productivity by about 0.9 percentage points in 1994.

This particular time-pattern in the regression coefficients -- starting negative and becoming (more) positive -- suggests the following interpretation. Initially, the allocation of financing favored subsequently worse performers, as the soft budget hypothesis would suggest. Politicians thus appear to have influenced bank lending by directing it to loss-making enterprises, leading to a negative relationship with subsequent enterprise restructuring. In later periods, relatively more financing went to firms which subsequently improve more. This suggest that the financial system improved as banks became more discriminating in their lending decisions and lent more to deserving firms, i.e., firms which subsequently improved. Banks thus appear to have become more independent of politicians over time, i.e., their loans became less subsidies and more genuine investments leading to productivity growth.

Comparing regressions with and without the bank financing variables (the latter is not reported) show that the inclusion of the bank lending variable does not diminish the importance of privatization. The privatization coefficients are significantly positive in both regressions and stay about the same while the explanatory power increases. This suggests that privatization and the imposition of financial discipline are complements rather than substitutes and lends further support to the SV model. It also suggests that once the initial productivity gains from privatization are obtained, financing becomes important to sustain TFP-growth.

Including the amount of net transfers each firm receives from the government as a separate variable does not change the privatization coefficients. The coefficients for SUBS are consistently negative, suggesting decreasing productivity growth by between 3.3 and 1.4 percentage points for each 100% change in subsidies. The coefficients do decline over time, however, suggesting that the allocation of subsidies has become more rational and the role of politicians in allocating subsidies has declined. Furthermore, since subsidies tend to be concentrated in only a few firms, especially in the later years, the magnitude of the overall effect of subsidies on overall enterprise restructuring is relatively small.

The majority of the coefficients on the country-time dummies are significant, but their signs differ across countries and over time - note that Slovenia is the base country. For 1992-93, the time dummy is significantly negative for Hungary, Poland, Romania and Slovakia, and significantly positive for the Czech Republic. For 1994-95, the time dummy is significantly negative for Bulgaria, and significantly positive for the Czech Republic, Poland and Slovakia. For the Czech Republic, the dummies are thus (significantly) positive over the whole period. The dummies for Hungary, Poland and Slovakia show an increase over time. Bulgaria and Romania show no improvement over time, or even a deterioration in some specifications (e.g., the coefficients for Bulgaria actually become significantly negative). This upward time pattern suggests that the external environment and overall institutional framework, including the degree of corruption, improved in most countries.

*Two-Step Estimation*

As discussed in Section V, we expect the endogeneity of privatization to be important. We attempt to correct for the bias introduced in selecting firms for privatization, using pre-privatization (1991) efficiency and other firm characteristics. Different hypotheses exist on the *sign* of the association between pre-privatization efficiency and the likelihood of privatization depending on the *mode* of privatization. If the privatization method is sales to outsiders, we would expect to see a positive association since outside investors (in the absence of any additional knowledge about the firm) would interpret past performance as a good indicator for future performance and would invest in firms with high initial efficiency. If privatization is mainly to insiders, we may expect to find a perverse relationship. This is because managers would have the incentive to show poor initial performance so that they could buy the firm at a cheaper price. The same could be the case in situations where an outside investor (including foreign investors) would strike a deal with current management to lower the price in exchange for keeping their jobs. Thus it is not clear *a priori* what association we may find on average across the seven countries.

The results from the first step regressions are reported in Table 7. We estimate probit regressions for each individual country and not for the sample as a whole. Since the country regressions are more likely to capture the differences in selection bias across privatization techniques, we use the MILLS variables generated in these regressions, rather than a full sample regression that may obscure the selection bias. The coefficients on the VCS:91 variable are positive (and significant) for Poland, and Slovenia; negative (and significant) for the Czech and Slovak Republics, and insignificant for Bulgaria (negative), Hungary (positive), and Romania (negative). The coefficient in the full-sample regression is positive and insignificant. This outcome is somewhat surprising - it could be interpreted to indicate that less efficient firms were more likely to be privatized during 1992-95. We favor the explanation given earlier - if privatization deals went to insiders, they had the incentive to let pre-privatization performance slip, so as to get a better price. Indeed, such hypothesis is supported by the signs across countries, since Poland and Slovenia had the most insider privatization in the sample and both show significant positive signs.

We next re-run equation (3) with the additional variable MILLS (Table 8) for the second-step regression. The MILLS coefficients is negative and statistically significant. This suggests that some endogeneity in privatization outcomes indeed exists. The other results are qualitatively similar to the ones reported in Table 6. The endogeneity correction influences the estimated effects of privatization but not in ways inconsistent with the theory. The privatization coefficients remain positive and significant although their magnitude decreases. Thus in 1994, the coefficient drops from 6.2% to 4.3%. The coefficients on SUBS also remain the same in sign and relative magnitude. The $BANKFIN_{94}$ coefficient (marginally) loses its significance. Some of the country coefficients change signs. Thus the Czech and Slovak coefficients in the last period turn negative, while the Bulgaria coefficient turns positive (but insignificant). But in general the two-step estimation provides further support for the SV model.

*Further Sensitivity Analysis*

One potential problem with the data is its different sources. In particular, one may suspect that the data for the Czech Republic and Hungary are biased towards better firms, since "bad" firms are less likely to cooperate on a voluntary basis with private surveys. In both cases, however, this is not an important issue. In Hungary, the data provider is contracted by the government to collect information on all firms which employ more than twenty-five workers. Such information is collected through the regional business registries. In the Czech Republic, our data provider is contracted by the government to collect and distribute information on all firms listed on the Prague Stock Exchange or the electronic stock market (RM-System). Thus although the survey is run by a private firm, replies are mandatory. A bias of a different nature exists, however. The majority of the 2,100 firms listed on either exchange in the Czech Republic are medium- and large-size. The sample, as is the case in Hungary, is biased away from small-size firms.

How does the sample selection affect our results for the Czech Republic and Hungary? We are likely to underestimate the effect of privatization on enterprise performance. This is because small firms are usually privatized to their managers and the principal agent problem between owners and managers, which is present in larger firms, is alleviated. In the Polish case, the scarcity of liquidation-privatization types also leads to a similar bias. This privatization route was designed primarily for management buy-outs where the new (old) management would be able to buy the firm through a highly leveraged deal, and at the same time (because of liquidation) declare the previous labor contracts void. Since these sales were primarily financed by borrowing, the ability of the firm to generate cash flow in the short to medium run (during the term of the loan) was an important factor in determining whether management would decide to launch the liquidation procedure.

To test for possible selection biases across all countries, we restrict the samples in the other five countries to firms that also have more than twenty-five workers and operate in manufacturing sectors. These restrictions do not qualitatively affect our results once we re-run all regressions using the truncated samples (not reported). They also alleviate the endogeneity of privatization (the coefficient on MILLS in the second-step estimation becomes insignificant), as argued in Barberis et al., 1996. The reason is that the most likely candidates for endogeneity are precisely firms which underwent management buy-outs - managers had the insider knowledge to proper evaluate the firms and their decision to buy could be treated as a signal of "hidden" value.

The use of balanced samples could also lead to a selection bias if less productive firms offered for privatization were not sold and subsequently exited. It could also lead to an overestimate of the performance of state enterprises as liquidated state enterprises performed worse. Given the lack of data that allow us to use unbalanced samples, and since the number of liquidated firms in the seven countries was negligible prior to 1996,[6] we assume that this omission

[6] Previous studies have argued that liquidation of firms in Hungary during 1992-93 led to significant exit. This is not the case. Although many firms applied for liduidation, the majority of them were still in operation at the

does not result in a significant bias. This assumption should, however, be tested in subsequent research.

We next test the robustness of our results to the inclusion of different sub-samples of countries. We re-run the empirical model while eliminating each one and then two country (countries) from the sample, which gives us six and forty-two additional sub-samples respectively. It may be the case that privatization has led to increased productivity in one (or more) countries while it has no significant effects in the majority of countries. If that were the case, the results from Tables 7 and 9 cannot be generalized as supporting the SV hypotheses. The regressions (not reported) do not show any qualitative differences from our earlier findings. The exclusion of Bulgaria (or Bulgaria paired with most countries) reduces the magnitude but not the significance of the privatization coefficients. This is likely the case since the few privatization deals in Bulgaria were biased towards the best firms. The exclusion of Romania (and Romania plus Bulgaria, or Romania plus Hungary) leads to similar results. The exclusion of Slovenia increases the magnitude of privatization coefficients. The effects on the subsidies and bank-financing coefficients are also noteworthy. The exclusion of Bulgaria and Romania turns the $BANFIN_{94}$ coefficient significant (positive), while the exclusion of Hungary turns the $BANKFIN_{92}$ coefficient significant (and negative).

Finally, we exclude from the sample all firms (across all seven countries) that have been sold to strategic (outside or inside) investors. This includes all sales to foreigners, managers, and through direct auctions. All other privatizations were the result of mass privatization (Czech and Slovak Republics, Poland, and Slovenia), partial privatizations to banks (in Poland and Slovenia), or initial public offerings (in Hungary and Poland). The results (not reported) support our previous findings. The privatization coefficient for 1994 shows some decline, but remains positive and significant. The exercises in this section reveal the robustness of our results to the particular sample(s) used. The theoretical predictions are supported consistently across all countries and using different sub-samples of privatized firms.

## VIII. Conclusions

This paper tests the implications of the SV model on the benefits of privatization in situations where politicians may influence firms to pursue political objectives. The empirical design we use allows for the effects of stabilization, corruption, and changes in the legal and institutional frameworks. We also avoid the selection biases in previous studies by focusing on firms in competitive sectors, and explicitly correcting for the endogeneity of privatization choices.

We find strong supportive evidence for the predictions of the SV model. State-owned enterprises employ more labor, have lower labor productivity, receive more financing and direct subsidies, and have higher variable costs than privatized firms, particularly compared to those firms privatized for more than three years. State-owned enterprises also show much lower

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end of 1995. The only exception, as mentioned, is Poland where about 1,000 state-owned manufacturing firms were liquidated.

productivity growth that privatized enterprises. These differences cannot be attributed to the overall environment in which enterprises operate nor to the selection bias introduced in the privatization programs. Correcting for a number of firm-specific factors, privatized firms consistently outperform state enterprises in terms of productivity growth. We also find empirical evidence for the SV-prediction that lack of monetary tightness discourages enterprise restructuring, at least in the early period of transition. Over time the role of politicians in allocating bank financing and subsidies appears to have declined, however, and the importance of banks in allocating resources (efficiently) increased. Finally, the overall institutional environment appears to have improved in almost all countries, suggesting that the influence of corruption has declined over time.

The results demonstrate the beneficial effects of privatization in the presence of stabilization and decreasing corruption. Further research could study the effect of various types of privatization on managerial behavior and enterprise efficiency as our research suggests that there are large differences across countries, possibly associated with the fact that certain privatization methods dominated in particular countries.

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**Table 1: Theory Predictions**
(Effects on Enterprise Performance)

| Policy | Soft Financing | | Excess Labor | | Efficiency | |
|---|---|---|---|---|---|---|
| | no corruption | full corruption | no corruption | full corruption | no corruption | full corruption |
| privatization without deregulation and without stabilization | ? | 0 | + | 0 | - | 0 |
| privatization cum deregulation, but without stabilization | + | 0 | - | 0 | + | 0 |
| privatization cum deregulation cum stabilization | - | - | -- | 0 | ++ | 0 |

Source: SV model. Notes: 0 indicates no effect; ? indicates the theory is inconclusive; + means a positive effect; ++ indicates a large positive effect ; - indicates a negative effect; -- indicates a large negative effect.

## Table 2: Statistics on Sample of Firms

| | Bulgaria | Czech Rep | Hungary | Poland | Romania | Slovak Rep | Slovenia |
|---|---|---|---|---|---|---|---|
| | A. Data Coverage | | | | | | |
| No of firms | 828 | 706 | 1,044 | 1,066 | 1,064 | 883 | 763 |
| Number of Employees 1992 | 418,382 | 829,312 | 428,645 | 1,338,629 | 2,678,436 | 578,737 | 272,249 |
| % of total* | 48 | 64 | 41 | 45 | 93 | 93 | 92 |
| | B. Size of Firms (Number of Employees) | | | | | | |
| Mean | 505 | 627 | 425 | 911 | 1521 | 656 | 357 |
| Median | 291 | 409 | 241 | 820 | 1327 | 335 | 213 |
| | C. Degree of Privatization | | | | | | |
| % of firms | 8 | 89 | 67 | 61 | 15 | 79 | 41 |
| % of total output | 7 | 93 | 65 | 60 | 12 | 83 | 42 |
| | D. Average Share of Sector Employment in Total Employment | | | | | | |
| Food | 12.0 | 5.4 | 11.2 | 8.7 | 8.4 | 13.7 | 10.4 |
| Tobacco | 0.8 | 1.5 | 2.6 | 1.1 | 1.6 | 0.8 | 1.9 |
| Textiles | 9.0 | 5.5 | 13.0 | 8.5 | 6.9 | 4.2 | 12.9 |
| Apparel | 5.1 | 2.3 | 3.7 | 1.9 | 1.1 | 3.4 | 5.8 |
| Lumber | 8.4 | 3.6 | 3.5 | 2.3 | 8.8 | 4.3 | 3.0 |
| Furniture | 2.8 | 1.2 | 2.8 | 2.0 | 5.5 | 1.6 | 3.2 |
| Paper | 3.1 | 1.5 | 1.6 | 1.4 | 1.5 | 1.9 | 1.7 |
| Printing | 0.7 | 3.3 | 0.9 | 0.4 | 5.1 | 2.9 | 1.1 |
| Chemicals | 6.7 | 2.3 | 8.0 | 7.9 | 8.8 | 7.6 | 8.0 |
| Petroleum refining | 3.8 | 2.6 | 4.4 | 3.2 | 6.7 | 1.0 | 1.0 |
| Rubber | 1.9 | 1.4 | 4.3 | 4.5 | 1.6 | 2.7 | 2.2 |
| Leather | 3.5 | 1.5 | 2.5 | 2.6 | 3.3 | 3.0 | 3.5 |
| Stone, clay, glass | 2.7 | 14.6 | 5.4 | 7.6 | 3.7 | 4.6 | 1.5 |
| Primary metals | 6.2 | 7.0 | 9.1 | ,0.6 | 1.8 | 4.8 | 13.5 |
| Fabricated metals | 2.9 | 9.8 | 3.9 | 4.6 | 10.3 | 14.6 | 4.0 |
| Nonelectrical machinery | 17.5 | 16.2 | 5.6 | 15.2 | 9.2 | 10.0 | 4.1 |
| Electrical machinery | 4.3 | 3.0 | 10.9 | 3.2 | 3.6 | 5.0 | 14.1 |
| Transport equipment | 0.8 | 12.6 | 3.7 | 11.6 | 9.0 | 8.8 | 2.4 |
| Instruments | 7.6 | 3.8 | 2.3 | 2.2 | 2.2 | 4.1 | 5.3 |
| Miscellaneous | 0.2 | 0.9 | 0.6 | 0.5 | 0.9 | 1.0 | 0.4 |

* Share of 1992 manufacturing employment as reported in the Statistical Yearbooks of the respective countries.

## Table 3: Description of Variables

| | |
|---|---|
| TFPG | Total Factor Productivity Growth |
| SIZE | Number of employees |
| LABPRO | Value-added (sales minus materisl expenditures) per worker in constant $US 1995. |
| BANKFIN | ratio of the change in total debt outstanding (net of interest charges) over sales revenue |
| SUBS | Direct subsidies from the budget, |
| VCS | variable cost share, wages plus material inputs over total sales |
| $PRIV_{1,2,3+}$ | Dummy for each cohort of firms in terms of the years following their privatization |
| COUNTRYii | Dummy for each country, as follows: DBUL (Bulgaria, DCZE (Czech Rep), DHUN (Hungary), DPOL (Poland), DROM (Romania), DSVK (Slovak Rep), DSVN (Slovenia). |
| $DSEC_i$ | Dummy for Sectors, as follows: Food and Kindred products (FOOD), Tobacco Manufactures (TOB), Textiles (TEX), Apparel (APP), Lumber and Wood Products (WOOD), Furniture and Fixtures (FUR), Paper (PAP), Prnting and Publishing (PRI), Chemicals (CHE), Petroleum refining (PET), Rubber (RUB), Leather (LEA), Stone and Cement (STO), Metals (MET), Nonelectrical Machinery (NMA), Electrical machinery (EMA), Transport Equipment (TRA), Instruments (INS) |
| $DYEAR_t$ | Dummy for Years, 1992, 1993, 1994, 1995. 1996 is taken as a numeraire |

## Table 4: Testing the Shleifer-Vishny Hypotheses

| | Number of Workers | | | Labor Productivity | | | Bank Financing | | | Direct Subsidies | | | Variable Cost Share | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1992 | 1995 | t-stat | 1992 | 1995 | t-stat | 1992 | 1995 | t-stat | 1992 | 1995 | t-stat | 1992 | 1995 | t-stat |
| State-owned firms (3,752 firms) | 1,159 (535) | 1,044 (429) | 1.244 | 7,854 (7,135) | 7,489 (6,742) | 0.783 | 31.5 (18.2) | 63.8 (30.6) | -19.691* | 0.062 (0.054) | 0.011 (0.013) | 21.361* | 84.3 (81.1) | 85.9 (82.2) | -3.092* |
| Privatized in 1994 (365 firms) | 575 (291) | 468 (241) | 1.232 | 9,175 (8,675) | 10,574 (9,126) | -1.208 | 26.8 (15.2) | 36.5 (17.8) | -1.396 | 0.021 (0.018) | 0.000 (0.000) | 15.261* | 90.6 (91.3) | 90.0 (90.4) | 0.464 |
| Privatized in 1993 (846 firms) | 1,154 (526) | 957 (367) | 1.487 | 9,468 (9,241) | 11,527 (10,984) | -3.001* | 24.1 (19.2) | 23.8 (18.5) | 0.080 | 0.008 (0.006) | 0.000 (0.000) | 1.805** | 87.3 (87.2) | 86.4 (86.2) | 1.354 |
| Privatized before 1993 (1,391 firms) | 761 (331) | 625 (224) | 2.800* | 11,524 (10,528) | 14,857 (13,652) | -5.221* | 33.9 (21.6) | 27.8 (17.4) | 2.483* | 0.003 (0.003) | 0.000 (0.000) | 0.890 | 85.9 (83.7) | 83.6 (81.5) | 4.933* |

* Significant at the 95% level. Median values in parentheses.

**Table 5: Total Factor Productivity Growth by Ownership**
(Annual Rates of Growth)

| | 1992-93 | 1993-94 | 1994-95 | 1992-95 | t-test |
|---|---|---|---|---|---|
| State-owned firms (3,752 firms) | 0.011 (0.010) | 0.012 (0.013) | 0.005 (0.008) | 0.026 (0.022) | --- |
| Privatized in 1994 (365 firms) | 0.016 (0.018) | -0.014 (-0.007) | 0.066 (0.047) | 0.062 (0.049) | -6.869* |
| Privatized in 1993 (846 firms) | -0.009 (-0.008) | 0.018 (0.021) | 0.039 (0.029) | 0.049 (0.045) | -4.206* |
| Privatized before 1993 (1,391 firms) | 0.062 (0.044) | 0.045 (0.031) | 0.023 (0.026) | 0.132 (0.117) | -12.157* |

* Significant at the 95% level. Median values in parentheses. T-tests between state-owned firms and other firms for the 1992-95 period.

## Table 6: Estimation Results on Privatization, Subsidies and Financial Tightening
(TFP-growth, random effects model)

| | Region |
|---|---|
| Constant | 0.024* |
| | (6.231) |
| Sector-specific input variables included | Yes |
| $PRIV_1$ | 0.029* |
| | (6.213) |
| $PRIV_2$ | 0.062* |
| | (14.441) |
| $PRIV_{3+}$ | 0.039* |
| | (8.512) |
| SUBS 1992 | -0.033* |
| | (6.723) |
| SUBS 1993 | -0.023* |
| | (4.538) |
| SUBS 1994 | -0.014 |
| | (1.455) |
| BANKFIN 1992 | -0.010 |
| | (1.437) |
| BANKFIN 1993 | 0.007 |
| | (0.376) |
| BANKFIN 1994 | 0.009* |
| | (2.034) |

Country-Time Dummies

| Year | DBUL | DCZE | DHUN | DPOL | DROM | DSVK |
|---|---|---|---|---|---|---|
| 1992-93 | -0.006 | 0.012* | -0.010 | -0.011** | -0.021* | 0.002 |
| | (0.698) | (2.024) | (1.465) | (1.813) | (2.143) | (0.226) |
| 1993-94 | -0.061* | 0.047* | 0.007 | 0.019* | -0.035* | 0.038* |
| | (3.658) | (6.296) | (1.008) | (2.124) | (4.235) | (5.324) |
| 1994-95 | -0.035** | 0.022 | 0.008 | 0.014* | -0.026 | 0.057* |
| | (1.772) | (1.728) | (1.785) | (2.336) | (1.436) | (6.452) |

| | |
|---|---|
| Sample Size | 19,062 |
| Durbin-Watson Statistics | 1.945 |
| Adjusted $R^2$ | 0.851 |

The estimates are heteroskedasticity consistent . t-Statistics (absolute values) shown in parentheses. * Significant at the 95% level. ** Significant at the 90% level.

## Table 7: Endogeneity of Privatization
(first step estimation, probit regression)

| | DBUL | DCZE | DHUN | DPOL | DROM | DSVK | DSVN |
|---|---|---|---|---|---|---|---|
| | Dependent variable is Privatization Choice (1 if privatized, 0 if not) | | | | | | |
| Constant | -1.021 | 0.502 | -0.849 | -2.092 | -1.137 | -0.537 | -3.397 |
| | (1.412) | (1.026) | (2.196) | (5.122) | (1.076) | (1.164) | (6.162) |
| VCS:1991 | -0.625 | -1.223 | 0.719 | 2.854 | -0.065 | -0.172 | 4.312 |
| | (1.489) | (2.842) | (1.651) | (9.628) | (0.234) | (1.798) | (6.642) |
| SIZE | -0.025 | -0.048 | -0.016 | -0.146 | -0.138 | -0.049 | -0.094 |
| | (0.238) | (0.908) | (0.419) | (5.574) | (1.978) | (0.876) | (2.354) |
| FOOD | -0.158 | 0.295 | 0.015 | 0.158 | 0.226 | 0.518 | 0.158 |
| | (0.438) | (2.354) | (0.897) | (0.749) | (1.358) | (2.774) | (0.879) |
| TOB | 0.493 | 0.683 | 0.248 | 0.609 | 0.674 | -0.157 | -0.485 |
| | (0.826) | (2.425) | (3.254) | (1.226) | (2.158) | (0.478) | (1.479) |
| TEX | 0.374 | 0.112 | 0.615 | 0.189 | 0.138 | 0.248 | 0.245 |
| | (2.847) | (0.449) | (2.724) | (0.754) | (0.348) | (2.897) | (1.054) |
| APP | 0.186 | 0.905 | 0.572 | 0.115 | 0.711 | 0.251 | 0.154 |
| | (0.462) | (3.478) | (2.145) | (4.518) | (1.268) | (2.135) | (1.897) |
| WOOD | -0.235 | -0.347 | -0.224 | -0.642 | -0.037 | -0.574 | -0.054 |
| | (0.648) | (1.982) | (0.908) | (2.264) | (0.087) | (2.106) | (0.857) |
| FUR | -0.157 | 0.553 | -0.125 | -0.152 | -0.068 | -0.296 | 0.036 |
| | (0.349) | (1.695) | (0.507) | (0.309) | (2.441) | (2.041) | (0.125) |
| PAP | 0.097 | 0.115 | 0.038 | no private | 0.694 | 0.044 | -0.162 |
| | (2.196) | (3.138) | (1.992) | | (2.123) | (1.178) | (1.457) |
| PRI | no private | 0.011 | 0.296 | 0.185 | no private | -0.748 | -0.075 |
| | | (0.029) | (0.895) | (2.916) | | (2.948) | (1.305) |
| CHE | 0.091 | -0.264 | 0.057 | 0.928 | 0.924 | -0.063 | -0.192 |
| | (2.534) | (0.785) | (0.278) | (4.087) | (2.418) | (0.274) | (0.778) |
| RUB | 0.274 | -0.306 | -0.274 | -0.102 | no private | -0.055 | 0.256 |
| | (1.015) | (0.968) | (1.085) | (1.542) | | (2.124) | (0.957) |
| LEA | 0.135 | 0.144 | 0.882 | 0.682 | 0.518 | 0.195 | 0.024 |
| | (2.341) | (0.328) | (2.537) | (2.724) | (1.957) | (0.748) | (2.157) |
| STO | -0.237 | 0.225 | -0.215 | -0.374 | -0.157 | -0.342 | no private |
| | (0.578) | (1.892) | (0.857) | (0.937) | (1.658) | (1.387) | |
| MET | no private | 0.256 | 0.167 | -0.487 | no private | 0.504 | 0.095 |
| | | (1.364) | (1.718) | (2.327) | | (2.078) | (0.284) |
| NMA | -0.135 | -0.211 | 0.271 | 0.115 | no private | 0.457 | -0.131 |
| | (1.568) | (0.695) | (1.254) | (0.388) | | (1.978) | (0.547) |
| EMA | 0.074 | 0.452 | 0.189 | -0.061 | 0.402 | 0.108 | -0.064 |
| | (2.689) | (1.909) | (2.748) | (0.206) | (1.138) | (0.516) | (1.968) |
| TRA | 0.167 | 0.678 | 0.225 | 0.162 | -0.087 | 0.211 | 0.084 |
| | (0.587) | (4.152) | (2.035) | (0.709) | (0.178) | (1.149) | (0.328) |
| INS | -0.059 | 0.771 | -0.425 | -0.082 | 0.674 | -0.034 | -0.151 |
| | (1.125) | (2.451) | (3.542) | (0.245) | (2.539) | (0.524) | (4.278) |
| Sample Size | 828 | 706 | 1044 | 1066 | 1064 | 883 | 763 |
| $R^2$ | 0.034 | 0.023 | 0.049 | 0.174 | 0.021 | 0.014 | 0.127 |

T-stats in parentheses.

## Table 8: Estimation Results on Privatization, Subsidies and Financial Tightening

(TFP-growth, second-step estimation)

| | |
|---|---|
| Constant | -0.001 |
| | (0.224) |
| Sector-specific input variables included | Yes |
| MILLS | -0.018 |
| | (4.658) |
| $PRIV_1$ | 0.032 |
| | (8.202) |
| $PRIV_2$ | 0.041 |
| | (15.497) |
| $PRIV_{3+}$ | 0.037 |
| | (9.567) |
| SUBS 1992 | -0.010 |
| | (2.478) |
| SUBS 1993 | -0.014 |
| | (2.154) |
| SUBS 1994 | -0.006 |
| | (1.197) |
| BANKFIN 1992 | -0.017 |
| | (1.415) |
| BANKFIN 1993 | 0.001 |
| | (0.166) |
| BANKFIN 1994 | 0.007 |
| | (1.968) |

Country-Time Dummies

| Year | DBUL | DCZE | DHUN | DPOL | DROM | DSVK |
|---|---|---|---|---|---|---|
| 1992-93 | -0.024 | 0.019 | -0.004 | -0.015 | -0.024 | 0.006 |
| | (3.561) | (2.495) | (0.642) | (2.441) | (4.045) | (0.722) |
| 1993-94 | -0.033 | 0.028 | 0.008 | 0.021 | -0.031 | 0.033 |
| | (7.451) | (6.763) | (1.355) | (3.352) | (9.462) | (6.982) |
| 1994-95 | 0.007 | -0.012 | -0.002 | 0.012 | -0.008 | -0.013 |
| | (1.584) | (7.574) | (1.449) | (4.785) | (0.764) | (6.827) |

| | |
|---|---|
| Sample Size | 19,062 |
| Durbin-Watson Statistics | 2.009 |
| Adjusted $R^2$ | 0.826 |

The estimates are heteroskedasticity consistent . t-Statistics (absolute values) shown in parentheses.

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